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Haemo-biochemical alteration in gastro-intestinal nematode infection in horses

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Abstract
In the present investigation, total 21 faecal samples of adult horses of either sex were examined for presence of parasitic ova. Out of which, 12 faecal samples were found positive for mixed and single infection of *Strongylus* spp. and *Parascaris* spp. The haematological study revealed significant decreased in Hb, PCV, TEC and lymphocytes, whereas increased in TLC, neutrophils, monocytes and eosinophils in nematode infected horses. Erythrocyte indices revealed normocytic normochromic anemia in GI nematode infected horses. Biochemical study revealed decreased in blood glucose, total serum protein, serum albumin and increased in globulin level in nematode infected horses.

Keywords: Biochemical, horses, haematology, *Strongylus*, *Parascaris*, nematode

Introduction
Gatro-intestinal nematode infection is one of the most important health problems causing heavy economic losses to the equine industry. These parasites are responsible for the poor health of equine due to their direct effects like irritation, annoyance, intoxication, reduced absorption of nutrients, emaciation, mechanical obstruction, tissue destruction, competitive food uptake, anaemia and even cause death when the control measures are neglected [1].
The mixed species nematode infection is most common in horses such as *Parascaris spp.*, *Strongylus* spp., *Strongyloides* spp., and *Cyathostoma* spp. [2, 3, 4]. The main clinical signs observed in nematode infested horses included weakness, dullness, decreased appetite, diarrhoea, rough hair coat, loss of body weight, poor body condition, anaemia, colic, pruritus, pot-belly and decreased performance and finally death of animal [5, 6]. Sometimes subclinical form of helminth infection may also reported in which the horse appear normal but parasitism is responsible for stunted growth in foal, reduce reproductive rate in mares and decreased immune system of horse [7].
Gatro-intestinal nematodes causes significant clinico-pathological changes and alters the normal haemo-biochemical parameters in affected animals such as neutrophilia, eosinophilia and anaemia, hypoproteinemia & hypoalbuminemia [8]. Hence, determination of haemo-biochemical parameters are extremely important to confirm presence or absence of a disease, to assess severity of a disease and to estimate response of therapy. Therefore, the aim of the present study was to assess the alterations in haemo-biochemical parameters in gastrointestinal nematode infection in horses.

Materials and Methods
The present study was carried out in the department of Veterinary Clinical Medicine, Ethics & Jurisprudence and Teaching Veterinary Clinical complex (TVCC), Post Graduate Institute of Veterinary and Animal Science, (PGIVAS, Akola).
Total 21 adult horses irrespective of sex in and around Akola district and horses brought to TVCC were screened for gastrointestinal nematode infection by examination of faecal sample by sedimentation and flotation methods [9]. Out of which, 12 horses found positive for gastrointestinal nematode infection on the basis of faecal sample examination and selected for study. Blood and serum samples were collected from all the horses under study from jugular vein for estimation of haemo-biochemical parameters. Haematological parameters *viz*. Haemoglobin (gm %), Packed cell volume (PCV) (%), Total Erythrocyte Count (TEC) (…X 10^6/cu mm), Total Leucocyte Count (TLC) (… x 10^3/ cu mm), Differential Leucocyte count (DLC) (%), Mean Corpuscular Volume (MCV) (fl), Mean Corpuscular Haemoglobin (MCH) (pg), Mean Corpuscular Haemoglobin Concentration (MCHC) (g/dl) were estimated by using automated haematology analyser (ABAXIS Vet Scan HM5). The biochemical parameters such as Total serum protein (g/dl), Serum Albumin (g/dl), Serum Globulin (g/dl) and Blood Glucose (mg/ dl) were estimated by using ready-made kits on biochemical auto-analyser (Rapid Diagnostic Pvt. Ltd. STAR 21 ^{plus}).

Results and Discussion

In the present research work total 21 faecal samples of adult horses of either sex in and around Akola district were screened for presence of parasitic ova in their faeces. Out of which, 12 faecal samples were found positive for GI nematodes. Of which 3 horses had mixed infection of *Strongylus* spp. and *Parascaris* spp. & 9 horses had single infection of *Strongylus* spp. and *Parascaris* spp. The mean values of haematological parameters in nematode infected horses and normal reference range are presented in Table 1.

Table 1: The average values of haematological parameters in nematode infected horses and normal reference range

Sr. No.	Parameters	Nematode infected horses	Normal Reference Range (Brar *et al.*, 2004).
1.	Haemoglobin (gm/dl)	8.55 ± 0.14	10-17
2.	PCV (%)	26.93 ± 0.92	30-51
3.	TEC (x10^6/cu.mm)	5.52 ± 0.08	6.5-12.0
4.	TLC (x 10^3/cu.mm)	12.11 ± 0.22	5-15
5.	Neutrophils (%)	62.00 ± 2.15	30-75
6.	Lymphocytes (%)	31.33 ± 2.52	25-60
7.	Monocytes (%)	2.17 ± 0.51	1-7
8.	Eosinophil (%)	3.50 ± 0.38	1-10
9.	MCV (fl)	48.76 ± 1.36	35-58
10.	MCH (pg)	15.50 ± 0.13	12-19
11.	MCHC (g/dl)	32.00 ± 0.74	31-37

In helminth infected horses, the mean Hb (8.55 ± 0.14), PCV (26.93 ± 0.92) and TEC (5.52 ± 0.08) was low as compared to normal references range [10]. Many researchers also reported low Hb, PCV and TEC in GI nematode infection in horses [11, 12, 13, 14, 15]. The low Hb, PCV and TEC in GI nematode infected horses observed in present study could be attributed to nature of helminth particularly *Strongylus*, which are voracious blood sucker causing direct loss of whole blood, leads to anaemia [13]. The migrating larvae and adult worms of *Strongylus* lead to anaemia due to damage, irritation and parasitic aneurysm verminous arteritis to the branches of intestinal arteries. The larvae may also causes haemorrhages in the liver parenchyma during migration and also by producing nodules in the wall of caecum and colon and considerable amount of bleeding take place when these nodules rupture leads to anaemia [16].

The mean MCV, MCH and MCHC values were within the normal range [10]. These findings of the present study suggestive of normocytic normochromic anaemia in GI nematode infected horses. Similar observations have been reported by many workers [17, 11, 18, 14].

In the present study, the mean TLC (12.11 ± 0.22) was within the normal range, Many researchers reported significant increase in TLC in helminth infected horses [19, 13]. The increased value of TLC in GI nematode infection could be due to localised inflammation in the intestine as *Strongylus* larvae causes large nodules in the walls of caecum and colon and also produce arteritis thrombosis and thickening of the walls of the cranial mesenteric artery resulted into leukocytosis [16]. The altered leucocyte count might also be due to larval migration of helminth parasites via liver and lung as observed in other studies.

The mean neutrophils (%), monocytes (%) and eosinophils (%) percent were higher whereas, mean lymphocytes (%) percent was significantly lower in GI nematode infected horses. The findings of the present investigation are in agreement with the findings of several workers, who also reported increased neutrophils, monocytes and eosinophils percent and decrease in lymphocytes percent in helminth infected horses. [13, 20, 21, 22].

In the present study, the elevated neutrophils (%) percent in helminth infected horses might be due to phagocytic action of neutrophils as helminth excrete toxic, inflammatory and allergic substances leads to neutrophilia [19]. It is further explained that the neutrophils secretes lytic substances to degrade helminths cuticular portions as pathogens [23]. The decrease percent of lymphocyte in helminth infection could be due to its involvement in immune mechanism [22] and also might be due to relative increase in neutrophil percent. The increase eosinophils (%) percent in the present investigation suggested constant irritation caused by the migrating larvae through intestinal mucosa causing damage and inflammation [24]. Other workers reported increase in eosinophil (%) due to the elevated IgE level in helminth infection which mediates mast cell degranulation and also involvement of eosinophils in local immune response which resulted in circulatory and tissue hypereosinophilia [25]. The increased monocytes (%) percent could be due to phagocytic action of monocytes, thus causing phagocytising and digesting the cellular debris.

In the present study various biochemical parameters were estimated in GI nematode infected horses. The mean values of biochemical parameters in nematode infected horses and normal reference range are presented in Table 2.

Table 2: The average values of biochemical parameters in nematode infected horses and normal reference range

Sr. No.	Parameters	Nematode infected horses	Normal Reference Range (Brar *et al.*, 2004).
1.	Blood Glucose (mg/dl)	62.01 ± 0.78	60-100 mg/dl
2.	Total Serum Protein (g/dl)	5.48 ± 0.09	6.0-7.7 g/dl
3.	Serum Albumin (g/dl)	2.58 ± 0.06	2.9-3.8 g/dl
4.	Serum globulin (g/dl)	6.63 ± 0.17	2.3-3.5 g/dl

In helminth infected horses, the mean blood glucose level was 62.01 ± 0.78, indicated slight low blood glucose level in helminth infected horses as compared to normal healthy horses of Akola district [15]. The low blood glucose level in helminth infected horses also reported by several researchers. [26, 27, 28]. The low level of blood glucose might be due to the fact that adult worm utilise the glucose for their own metabolism. The parasites causes catarrhal enteritis due to penetration of the intestinal mucosa resulted into poor absorption of glucose through intestine, which may also leads into decreased in blood glucose level in nematode infected horses [9, 16, 29]. It is documented that the heavy nematode infection in intestine alter the intestinal motility, permeability and absorption leads to malnutrition and inappetance resulted into hypoglycaemia [16].

In GI nematode infected horses, the mean total serum protein level was 5.48 ± 0.09. These findings of the present study indicated slight low total serum protein level in helminth infected horse than the normal reference range [10]. The present findings agree with the reports of many workers, who also reported low total serum protein level in helminth infected horses [30, 31, 27, 28]. The decline in total serum protein level in nematode infected horses could be attributed to poor absorption capability of gastrointestinal tract to absorb and assimilate the dietary content because of the gastrointestinal disturbances due to helminth infection. According to some researchers, the hypoproteinemia might be due to leakage of plasma protein into the intestinal gut due to bleeding from mucosal ulceration caused by the worms or protein exudation associated with intestinal inflammation as a result of intestinal nematode, which leads to hypoproteinemia which resulted into weakness, debilitation and pot-bellied appearance [30].

The mean serum albumin (g/dl) level was 2.58 ± 0.06 in helminth infected horses, indicated slight decline in serum albumin level in helminth infected horses as compared to normal reference range [10]. These findings of the present study are in similar with the reports of several workers, who also reported decline in albumin

level in helminth infected horses [30, 26, 27, 28]. The decline level of albumin in nematode infected horses could be associated with excessive protein loss due to bleeding from intestinal mucosal ulceration or protein exudation resulted due to intestinal inflammation by the GI nematode.

In helminth infected horses, the mean serum globulin level was 6.63 ± 0.17. These observations demonstrated increase in serum globulin level in nematode infected horses as compared to normal reference range of serum globulin level [10]. The rise in globulin level in helminth infected horses also reported by many researchers [32, 33, 34, 8]. The rise in globulin level in nematode infected horses might be due to loss of albumin through gut and rise in beta globulines in the serum in nematode infected horses [18].

The overall study demonstrated decreased in Hb, PCV, TEC and lymphocyte (%) whereas increased in TLC, eosinophils and neutrophils (%) in nematode infected horses. Biochemical study revealed decreased in blood glucose, total serum protein, serum albumin and increased in globulin level in nematode infected horses. Erythrocyte indices revealed normocytic normochromic anemia in GI nematode infected horses.

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